309

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Title:Defect engineering in CdS<inf>x</inf>Se<inf>1-x</inf> nanobelts: An insight into carrier relaxation dynamics via optical pump-terahertz probe spectroscopy

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Abstract:Defects in nanomaterials often induce dramatic changes in the photoelectrical properties of semiconducting II-VI compound nanomaterials. The relationship between defects and carrier dynamics is pivotal in material engineering for potential applications. A thorough understanding of the dynamics of defect-related free carrier depletion is particularly important for the fabrication and optimization of nano-optoelectronic devices. In this work, optical pump-terahertz probe spectroscopy was employed to investigate the carrier dynamics in CdS and Se-alloyed CdS nanobelts. The dynamics are dominated by the surface defect trapping in the case of CdS and structural-defect-related recombination for the Se-alloyed CdS. The conclusion is also supported by temperature-dependent photoluminescence spectroscopic studies. Our results indicate that congeneric element replacement is an effective approach for defect-distribution restructuring, which modifies the physical properties of nanomaterials through defect engineering. © 2012 American Chemical Society.

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Controlled terms:Cadmium compounds - Cadmium sulfide - Dynamics - Nanostructured materials - Optical pumping - Optoelectronic devices - Professional aspects - Semiconducting selenium compounds - Spectroscopic analysis

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